

STATEMENT OF BASIS/FINAL DECISION AND RESPONSE TO COMMENTS SUMMARY

REGION II
ID# 9999

Army Garrison – Fort Buchanan Bayamón, Puerto Rico (Signed on March 1, 2016)

Facility/Unit type:	Sites 2, 3, 9, 11 and 12
Contaminants:	Aluminum, Arsenic, Chromium (total), Cobalt, Manganese, Vanadium, Iron
Media:	Soil
Remedy:	No Action with Monitoring of Land Use to assure no changes in the way the sites are used

FACILITY DESCRIPTION

The Army Garrison-Fort Buchanan (Fort Buchanan), with oversight from the United States Environmental Protection Agency (EPA), engaged in a voluntary corrective action after volatile organic compounds (VOCs), primarily trichloroethylene (TCE), were detected in groundwater monitoring well samples collected within the adjacent property (now Puma Energy Caribe LLC) in 2004. As a result, the US Army Environmental Command (AEC) conducted two separate RCRA Facility Investigations (RFI); one to determine the nature and extent of groundwater contamination at the Northwest corner of the facility, (aka “Northwest Boundary Groundwater Site”) and another to determine the nature and extent of potential contamination resulting from former activities at 14 Sites (aka “Site-wide”). For the Northwest Boundary Groundwater Site, EPA has already reached a Remedy Decision in 2012, thus is not the focus of this Statement of Basis (SOB). This SOB is therefore focused on the proposed remedial alternatives for Sites 2, 3, 9, 11 and 12, in which contaminants of concern (COCs), particularly metals (see Table below) exceeded the screening criteria for industrial soil. Those sites are part of the Site-wide.

The facility is located approximately 10 kilometers southwest of San Juan, Puerto Rico. The facility is bordered by Roosevelt Avenue to the east, road PR-No. 2 to the south, road PR-No. 28 to the immediate northwest (with Puma Energy Caribe LLC beyond) and De Diego Expressway to the north. The facility occupies approximately 746 acres within two municipalities, Bayamón and Guaynabo. Physiographically, the facility is located on the northern coastal plain of Puerto Rico, which is about 5 miles wide and slopes gently upward to the central mountain chain, the Cordillera Central.

The facility was established in 1923 under the name of Camp Buchanan, originally located on a 300-acre tract of land approximately six miles south of San Juan Bay. From 1926 to 1930 Camp Buchanan was used as a maneuver training area and range by the regular Army, by National Guard troops, and as a Citizen Military Training Camp. In 1940 it was designated as Fort Buchanan and expanded to

1,514 acres, later expanding to 4,500 acres. After World War II, the facility was gradually reduced in size to its present 746 acres. Today, Fort Buchanan continues to support the reserve- and active-component soldiers in Puerto Rico and the U.S. Virgin Islands. From 1966 to 1971, Fort Buchanan was under the command of the U.S. Navy. In 1972, the Army resumed command and placed the U.S. Army Garrison, Fort Buchanan under the control of U.S. Army Forces Command. On October 1st, 2005 Fort Buchanan began a one year transition into the U.S. Army Reserve in accordance with the Puerto Rico Island-Wide Garrison Concept Plan of 12 May 2004. Fort Buchanan’s mission is to provide standardized services and sustainable infrastructure in support of the Armed Forces and the diverse Fort Buchanan community.

Individual Sites Description

- **Site 2**, or Solid Waste Management Unit (SWMU) 3, is located on the western side of Fort Buchanan, immediately south of the Puma Energy facility and was first identified as a SWMU because it was suspected to be the location of a historical disposal trench for pesticides. Numerous investigations have not identified any evidence of a disposal trench, disposal activities, or a release of pesticides at the site.
- **Site 3**, or SWMU 4, is located in the western portion of Fort Buchanan at the southwest portion of the Building 556 yard near the facility boundary. According to the 2012 Final Site-wide RFI Report, several 55-gallon drums containing spent solvents were historically stored at Site 3. According to the 2012 Final Site-wide RFI Report, spent solvents are no longer stored at the site.
- **Site 9** is located in the western portion of Fort Buchanan south of the former Directorate of Public Works (DPW) building and is the location of a former used oil staging area. The 2012 Final Site-wide RFI Report reported that eight 55-gallon drums of used oil were present at the site on top of a gravel surface without secondary containment and soil staining was observed.

- **Site 11** is located in the western portion of Fort Buchanan southwest of the former DPW and east of Site 3 and west of Site 9. Site 11 is identified as a heavy equipment storage area where releases of petroleum products from equipment occurred over time.
- **Site 12** is located in the southwest portion of Fort Buchanan, adjacent to and just southwest of the elementary school and is identified as a former unpermitted dump site that operated from the 1960s until the early 1990's. Construction debris, grass clippings, paint cans, oil drums, and other materials were reportedly disposed of at Site 12 but have since been removed by the facility.

SITE GEOLOGY AND HYDROGEOLOGY

According to the geologic maps of the Bayamón Quadrangle and the San Juan Quadrangle, the coastal plain, wherein the facility lies, consists of unconsolidated deposits of Quaternary Age alluvium sands, silts, and clays which characterize the northern two-thirds of the surface geology of the facility and most of the relatively flat central valley of the facility areas. A range of Neogene age limestone (Aguada) outcrops, known as Montes de Caneja, occurs along the northern boundary of the facility, and a second ridge, which is part of the Cibao formation, forms the southern boundary. The Cibao Formation stratigraphically underlies the Aguada Formation.

Data obtained during the Northwest Boundary Groundwater Site RFI indicates that, while not uniform across the facility, approximately 20 to 40 feet (ft) of clay overburden was encountered prior to contact with the uppermost carbonate sand aquifer. The overburden tended to thicken as the investigation moved northward. Underlying the clays and silts were varying degrees and ranges of a carbonate sand unit comprised of fine to large gravel and coarse sands, mostly yellow to pale brown in color. Beneath the water table, these zones were mostly saturated. In many of the wells, two distinct carbonate zones (older and younger terrace zones) were found separated by approximately two to 20 ft of fine material. However, data gathered during the installation of the seven northernmost wells suggested one carbonate sand layer north of the site. Underlying the carbonate layer was often a greenish gray silt material.

The hydrogeology of Fort Buchanan consists essentially of a two-aquifer system that is connected, with the older terrace being the source for the recharge of the younger terrace. The older terrace occupies the southern end of the study area in the uplands, while the younger terrace represents the northern lowlands. Both aquifers are in the carbonate sands. Low-permeability overburden covers the area; thereby preventing, or limiting, infiltration in the study area. The upland area to the south provides

recharge to the study area. The overburden thins out in the southern uplands, and the aquifer surfaces there to recharge. The older terrace material consists of alternating sand and silt, and dips below the younger terrace material. It has a strong, immediate response to rain events, and is not affected by tides. The younger terrace, alternatively, forms the northern half of the study area. It communicates with the older terrace, but not excessively. It is also an alternating sand/silt one-to-two aquifer system. The wells within the younger terrace have a lesser response to rainfall, and are affected by tides. Groundwater flows south to north, with a steep gradient from the southern end of the investigation area and flattening out north of the former DPW complex and across Route 28. Groundwater levels are tidally influenced in many of the wells.

EXPOSURE PATHWAYS

COCs in soil recommended for the Corrective Measures Study (CMS), at these five sites, are metals identified in the Human Health Risk Assessment (HHRA) as risk/Hazard Index (HI) drivers, which contributed to a total cumulative site cancer risk for a particular receptor group greater than 1×10^{-4} or a total cumulative target organ hazard for a particular receptor group greater than one. These soil COCs for the CMS are identified in the following table:

List of COCs

Site (Land Use Scenario)	COCs
Site 2, 3, 11 (Adult Construction Worker)	Arsenic, Chromium (VI), Cobalt, Manganese, Vanadium
Site 2, 3, 11 (Child Resident)	Aluminum, Arsenic, Chromium (VI), Cobalt, Iron, Manganese, Vanadium
Site 2, 3, 11 (Adult Resident)	Arsenic, Chromium (VI), Manganese
Site 9 (Adult Construction Worker)	Arsenic, Chromium (VI), Cobalt, Iron, Manganese
Site 9 (Child Resident)	Aluminum, Arsenic, Chromium (VI), Cobalt, Iron, Manganese, Vanadium
Site 9 (Adult Resident)	Arsenic, Chromium (VI), Cobalt, Manganese

Risks to human receptors were calculated and included incremental carcinogenic risks and hazard quotients (HQ). The acceptable risk range for incremental carcinogenic risk is one in one million (1×10^{-6}) to one in ten thousand (1×10^{-4}) (40 CFR 300). Unacceptable risks for potential receptors were identified when cumulative carcinogenic risks exceed the upper-bound of the acceptable risk range (i.e., 1×10^{-4}) or cumulative non-carcinogenic risks exceed a HI of 1.0 per target organ.

- The results of the HHRA indicate Sites 2, 3, and 11 have potential concerns for non-carcinogenic risk for the resident child and potential carcinogenic risks for the hypothetical lifetime resident. Therefore, the Site-wide RFI recommended Sites 2, 3 and 11 be carried into the CMS. There are no exceedances of the carcinogenic or non-carcinogenic risk thresholds for current users, the adult and adolescent trespasser, and commercial worker at Sites 2, 3, and 11. Metals that contribute to the risk include arsenic and total chromium for the carcinogenic risk, and arsenic and manganese have non-carcinogenic hazards above 1. It was noted that chromium was assumed to be hexavalent chromium since chromium was not speciated during the Site-wide RFI. Manganese may present potential risk concerns for residential receptors at grouping of Sites 2, 3 and 11.
- For Site 9, the risk assessment concluded that there are non-cancer risk concerns for construction workers for manganese. Additionally, the risk assessment concluded that there are potential risk concerns for residential exposure to arsenic, total chromium, iron, and manganese in subsurface soil and that exposure to cobalt present in soil is not a concern with regard to risk.
- For Site 12, the results of the HHRA in the Site-wide RFI indicate that there are no risk concerns. Therefore, there were no potential concerns for receptors at Site 12.

A Baseline Ecological Risk Assessment (BERA) was performed in general accordance with EPA guidance and agreements made between stakeholders, regulators and Fort Buchanan. The BERA is summarized below:

- For Site 2, seven metals (arsenic, chromium, cobalt, mercury, nickel, selenium, and vanadium) in subsurface soil reported concentrations that exceeded plant benchmarks under the future exposure scenarios and four metals (arsenic, chromium, mercury, and selenium) exceed the soil invertebrate benchmarks under a future exposure scenario. Of those, only selenium did not exceed the no effects benchmark for wildlife.
- For Site 3, nine metals (aluminum, arsenic, chromium, cobalt, copper, manganese, selenium, thallium, and vanadium) were detected in subsurface soil with concentrations exceeding plant benchmarks under the future exposure scenarios and four metals (arsenic, chromium, manganese, and mercury) exceed the soil invertebrate benchmarks under a future exposure scenario. Three metals (aluminum, thallium, and vanadium) exceed the no effects benchmark for wildlife.
- For Site 9, aluminum, arsenic, chromium, cobalt, copper, manganese, mercury, selenium, and vanadium exceeded benchmarks to plants. Maximum concentrations of many

of the metals were low, close to background concentrations.

- For Site 11, seven metals (aluminum, arsenic, chromium, cobalt, manganese, selenium, and vanadium) in subsurface soil with concentrations exceeding plant benchmarks under the future exposure scenarios and five metals (arsenic, chromium, manganese, mercury, and selenium) exceed the soil invertebrate benchmarks under a future exposure scenario. Four metals (aluminum, manganese, selenium, and vanadium) exceed the no effects benchmark for wildlife. In consideration of plant and invertebrates, the levels are expected to fall below low effects levels.
- For Site 12, metal detections do not pose a risk to plants and soil invertebrates due to concentrations being consistent with background. The maximum concentration of three metals (aluminum, lead and vanadium) exceeds no wildlife effects benchmarks; however, the concentrations are either below background or low-effects benchmarks. Therefore, it was concluded that metals detections in soil, sediment and surface water at Site 12 were unlikely to pose a potential risk to wildlife.

In summary, The Ecological Risk Assessment determined that there are no unacceptable risks to plants, soil invertebrates, or wildlife under current exposure scenarios at Sites 2, 3, 9 and 11. The ecological risk assessment for Site 12 found that metal detections do not pose a risk to plants and soil invertebrates due to concentrations being consistent with background. Stakeholder concerns, including EPA and the Puerto Rico Environmental Quality Board (PREQB), during the review of the Site-wide RFI and BERA lead to an agreement that Site 12 be considered in a CMS because Site 12 is a former dump area and is the location of a protected habitat for the endangered species, the Puerto Rican Boa. Therefore, Site 12 is included in the CMS to ensure disturbances to the dump area and protected habitat do not occur.

SELECTED REMEDY

Since Sites 2, 3, 9, 11, and 12 will remain in their present states as industrial-use sites or endangered species habitat, the preferred alternative includes “No Action with Monitoring of Land Use” to assure no changes in the way the sites are used:

- Site 2 is zoned for community land use and is being developed for non-residential land use with newly constructed buildings and parking lot for the Army National Guard usage.
- Sites 3, 9 and 11 are zoned for industrial land use and are undergoing active construction for solar panels and carports with asphalt covering for use as parking.

- Site12 is zoned for community land use. Fencing and vegetation currently limit access to the site.
- The Army maintains policies and procedures to prevent residential land use in the future without Army approval and acceptance at all sites included in this CMS.

INNOVATIVE TECHNOLOGIES CONSIDERED

In addition to the preferred alternative of “No Action”, other alternatives considered were the establishment of Institutional Controls, establishment of Engineering Controls, Excavation, and *In-situ* Stabilization. Some of these alternatives are not applicable to Fort Buchanan or already exist due to Site conditions. None of these remedial alternatives are considered innovative technologies

PUBLIC PARTICIPATION

On July 9, 2015 a notice inviting the public to comment on the proposed remedy for the Sites was published by EPA

on the *El Nuevo Día* newspaper. The Army published additional notices, in both English and Spanish, on the same newspaper on July 15, 2015. A 30-day public comment period on the proposed remedy was opened from July 27 to August 27, 2015.

A public meeting was also held in the San Juan Marriot Hotel on August 6, 2015. There were fourteen (14) people that attended the meeting. The attending were representatives from EPA, PREQB, US Army Environmental Command (AEC), US Army Corp of Engineer Jacksonville District, US Army Garrison Fort Buchanan Environmental Office, and, contractors and subcontractors in the Fort Buchanan community. No comments from the public were received.

NEXT STEPS

Following approval of the CMS. EPA will work diligently with AEC and Fort Buchanan representatives in order to monitor and ensure that current protections are maintained in the foreseeable future.

MAXIMUM DETECTED CONCENTRATIONS VS. REMEDIAL GOAL (RG*) BY SITE

Metal	Background (mg/kg)	RG (mg/kg)	Maximum Detected Concentration (mg/kg)				
			Site 2	Site 3	Site 9	Site 11	Site 12
			Subsurface	Subsurface	Subsurface	Subsurface	Surface
Aluminum	30,027	1,885,397	Not reported	32,200	23,400	25,300	19,100
Arsenic	43.87	380	45.4	122	166.1*	119	7.9
Chromium	69.8	721	72.4	89.3	184	140	27.2
Cobalt	16.57	595	0.75	45.3	104	23.7	9.4
Iron	47,064	1,412,160	ND	95,300	127,000	70,000	23,400
Manganese	1,184	32,699	ND	12,800	7,150	3,040	406
Vanadium	145	18,085	202	291	232	241	77.6

*RGs were calculated for each site in consideration of a range of risk (10^{-5} and 10^{-4}) and HQ of 1. The RGs were developed using the exposure parameters presented in Table 2, Appendix B of the CMS and are the same as those used in the HHRA with the exception of soil ingestion for a commercial/industrial worker. The HHRA used a 50 mg/kg soil ingestion rate and the RG calculation assumes 100 mg/kg soil ingestion. For more information see Appendix B of CMS.

*Value represents the 95% UCL of the mean for all collected samples, which includes both the parent and duplicate results. Highest detected concentration was 239 mg/kg.

KEY WORDS:

Soils, metals, risk, exposure, SWMU, land use, military installation, corrective measures, remedy decision, Puerto Rico, Fort Buchanan.

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